



# The relationship between hospital volume and outcomes of radical prostatectomy: a new perspective on an old story

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In the last decades, there has been a significant improvement in the management and treatment of prostate cancer (PCa). The course of both the localized and advanced disease has deeply changed, thanks to the development and widespread of robot-assisted radical prostatectomy (RP), new drugs, and new radio-oncological machines.

The increased complexity of patient management and treatment individualization questioned the need to centralize complex surgical procedures in tertiary care centers in order to optimize healthcare costs and patient outcomes. This issue has already been addressed by Luft *et al.* in 1979, with the authors demonstrating decreased mortality rates in surgeries performed at high-volume hospitals (1). However, a full agreement on this topic has not been reached yet. Some authors questioned about the connection between caseload and long-term outcomes, while others wondered if hospitals' volume was more relevant than surgeons' experience (2,3).

Barzi *et al.* recently added a valuable contribution in order to untangle this relevant topic (4). They performed a retrospective analysis on the National Cancer Database (NCDB), focusing their analysis on RP, which is one of the most complex urological procedures and one the most common uro-oncological surgery performed in US (5).

Previous studies investigated many aspects of the volume-outcome relationship after RP. In this context, non-oncological outcomes are the ones that have been studied best. Many authors, indeed, pointed out the correlation

between higher hospital volume and decreased rate of in-hospital complications, perioperative morbidity, length of stay (LOS), late urinary complications, and readmission risk after RP (6). On the other hand, many studies reported that increasing surgeon volume was associated with similar benefits (6).

A few studies examined the impact of hospital and surgeon volume on oncological outcomes after RP. In a retrospective analysis on 12,635 men, Ellison *et al.* showed that patients treated at lower-volume institutions were at increased risk of subsequent adjuvant therapies (7). Other authors also found an increased rate of salvage therapy associated with lower surgeon volume (8). In addition, higher risk of positive surgical margins has been associated with both lower-volume hospital and surgeon's although data are still controversial (9-12). Other studies looked at the relationship between volume and mortality. Hospitals' volume appeared to be inversely related to operative and in-hospital mortality, both in pre-robotic and robotic era, as well as hospitals' experience had an impact on 30-day mortality after RP (13-16).

However, the most reliable parameter to evaluate the volume-outcome relationship is still being debated. Some data suggested that high procedure-specific volume is the most significant predictor of in-hospital mortality (17). Hospital and surgeon volumes have often been investigated as distinct variables, though they are obviously interconnected. In this context, Barzi *et al.* added some

relevant novelties. First, they distinguished between facility annual caseload (FAC) and facility annual surgical caseload (FASC). FAC was calculated from the number of patients with PCa treated each year, regardless the stage or therapy. FASC was calculated from the number of radical prostatectomies performed at a given facility each year. Barzi *et al.* included for the first time FAC and FASC in the same study, using them as distinct measures of hospitals' volume, and comparing the strength of their association with outcomes after RP. Secondly, the primary outcome taken into consideration was overall survival (OS). Specifically, the FAC and FASC variables were used to divide facilities in 4 distinct volume groups (VGs) according to caseloads, using 50<sup>th</sup>, 75<sup>th</sup> and 90<sup>th</sup> percentile as thresholds. A multivariable regression model was used to analyze OS by VGs with adjustments for other prognostic factors. Interestingly, when VGs were defined on the basis of the facility PCa caseload, the survival benefit conferred by the high-volume facilities was larger than when VGs were constructed by the facility surgical caseload. They also observed that the differences in OS by FAC or FASC VGs were stronger among patients with low or intermediate National Comprehensive Cancer Network (NCCN) risks than those with high NCCN risks. The reason for this finding is unclear. Since high-risk PCa patients are more likely to need other treatments after surgical procedure, we could expect to find the greatest difference between FAC and FASC in that group of patients.

While several studies reported better short-term outcomes at high-volume hospitals, long-term survival outcome was a missing piece in the puzzle of volume-outcome relationship for PCa (6). This study found an improvement in the 5-year survival for patients with localized PCa who were treated primarily with RP at high-volume centers (4). Specifically, this benefit was significantly higher for patients who were treated at high overall-volume hospitals compared to high surgical-volume hospitals. This finding suggests that the overall caseload of the facility may be more important than the facility's surgical caseload alone.

Previous studies suggested that the importance of surgeon volume could be overestimated, given that most of the high-volume surgeons work in high-volume facilities and therefore take advantages to all the relative benefits. Some authors, investigating outcomes after radical cystectomy, found that hospital volume is independently associated with survival, even when accounting for surgeon volume, but not vice versa (3). Thus, according to these data, surgeon experience is not a significant predictor of

mortality.

Barzi *et al.* took a step forward in that direction. Their results support the idea that surgical act itself is less important than overall management of the patient. Broad structural approach that characterized high-volume facility, regardless of surgical volume, seems to be more important than surgical skills themselves. High-volume hospitals are usually supposed to have better preoperative testing, greater staff volume in terms of nurses, greater availability and higher quality of services, such as diagnostic and interventional radiology. However, while these factors can account for differences in short-term outcomes, they lose importance when looking at long-term survival. Therefore, the reasons under this correlation are not clear, but some hypothesis can be made. For example, the management of an oncological patient requires a multidisciplinary team: patients treated at large hospital are more likely to receive their entire course of treatment at the same place. Conversely, continuity and efficiency of care can be both mined in small centers. Of note, Barzi *et al.* showed a significant impact of being treated at more than 1 facility. This was true specifically for lower VGs (4).

Even if clearly presented and thought-provoking, the study has some limitations. The NCDB is an essential source of standardized data for cancer surveillance providing standardized data regarding patients, hospitals, and therapies (18). However, NCDB data do not allow to calculate cancer-specific survival (CSS). Given the excellent life expectancy of patients diagnosed with localized PCa, the median OS was not reached after a median follow-up of 5 years. Since almost 100% of men who have regional PCa will survive more than 5 years after diagnosis, OS may be considered not a valid CSS surrogate in this population (19). In this regard, it is noteworthy that more than 70% of patients in the study had low or intermediate-risk PCa.

Therefore, most of the deaths reported in the first 5-year after RP are very likely to be due to reasons other than cancer (19). In addition, survival estimates may be further biased by differences in baseline characteristics between populations treated at different VG hospitals as shown in the supporting table 1 (4). Compared to higher volume facility, hospitals below the median have a greater proportion of Black and Hispanic patients. Differences in socioeconomic status exist, with patients referring to lower volume hospitals having lower income and education. These factors have been demonstrated to influence quality of care and to be independently associated with worse survival after RP (20-23). Therefore, the gap in OS between FAC

and FASC groups could be partly due to these differences. Whether baseline characteristics are significantly different or not is an essential exploratory analysis not undertaken here.

Barzi analyzed also the appropriateness of adjuvant therapies after prostatectomy. We would like to point out that in 30% of cases adjuvant treatment was indicated but not given (4). The proportion of this issue is similar within VGs, as well as, in FAC *vs.* FASC. This could be explained by the general belief that RP is curative.

To conclude, the authors made a remarkable effort to analyze the impact of volume on patients' survival, that is an under-studied outcome. They used one of the largest cohorts available in literature. Notwithstanding the retrospective nature of the study, Barzi *et al.* examined the hospital caseload from a new point of view, giving a significant contribution in order to identify the causes of the volume outcome relationship.

However, given the long-term survival rates of the PCa, the choice of OS with a median follow-up of 5 years reduce the strength of the findings. We believe future analyses with a longer follow-up time could provide further insights in the oncological outcome and hospital/surgical volume relationship.

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## Footnote

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